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AN EXAMINATION OF THE OFF-FARM LABOR SUPPLY OF SMALL FARM HOUSEHOLD MEMBERS: THE CASE OF LAGUNA, THE PHILIPPINES

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INTRODUCTION

Background

Off-farm employment by farm household members in low income countries has been largely ignored by development planners and theoreticians. Much of the empirical analysis concerning rural development ignores the time allocated by farm household members to activities other than on-farm production, and the often substantial amount of income generated by these activities. The persistant problems of underemployment, aggravated income inequality, and rural poverty, however, demand a rethinking of means to improve the economic and social welfare of the rural poor.

During the past two decades, many countries have employed development strategies emphasizing large-scale, capital-intensive activities in both the agricultural and non-agricultural sectors, and have often favored the urban-industrial sector, while neglecting the rural non-commercial population. A reexamination of this strategy is currently underway, with

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increased attention being directed to small-scale industry and a broad range of rural nonfarm activities employing a large share of the rural population. The research on which this new strategy is based may be divided into two primary types: aggregate studies showing the importance and growth of certain types of employment (Johnston & Kilby, 1975; Mellow, 1976; Edwards, 1977; and Anderson & Leiserson, 1978); and studies of the performance and problems of small-scale, non-agricultural firms (Shinohiun, 1968; Oshima, 1971; and Ho & Huddle, 1975). A third dimension of research are the recent studies by Fuhs and Vingerhoet (1971), Larson & Hu (1977), Hart (1977) and Meyer et al. (1978) which suggest that off-farm earnings are an important component of the farm household's total income in such diverse Asian countries as Thailand, Indonesia, Taiwan, and Korea. Some of the household members live and work away from the farm, but regularly send remittances to the farm household; other households are those in which various members work primarily on the farm and occasionally earn off-farm wages; still other households tend to specialize their labor inputs with some members allocating all working time to off-farm employment, while others allocate all their time to farm activities.

A rural development strategy designed to increase off-farm employment can make several important contributions. First, under-utilized labor can be employed at wages which exceed the marginal returns to farm labor. The demand for farm labor is generally seasonal, permitting greater productivity and renumeration in the nonagricultural sector during slack seasons. Second, lesser skilled household members may substitute their labor in on-farm activities. This not only releases the more highly skilled household members to work a greater amount of time off the farm, but allows for the

acquisition of skills by a larger share of the rural population. Third, off-farm earnings may provide stability by reducing the cyclical fluctuations found in farm earnings. Fourth, an increase in household income as a result of off-farm employment may be expected to have an impact on household consumption and saving patterns. Johnston & Kilby (1975) report that there is a linkage between the household's consumption of processed food, clothing, wood, leather, and farm inputs and the production of these goods by local firms. Fifth, by reducing the need to migrate in order to realize satisfactory income levels, it is expected that people may be retained in the rural areas to contribute to both agricultural and non-agricultural growth. Sixth, off-farm earnings contribute to the household's welfare by serving as an additional source of liquidity.

The extent to which these potential contributions are able to be realized depends on: 1) the governmental commitment to this strategy; and 2) the response by farm households to increased off-farm opportunities. The first of these conditions was at least nominally met in 1973 when President Marcos committed the Philippines to a program promoting small industries in rural areas as one of the measures for attaining the goal of social justice (Anton, 1973).

The response by farm households to off-farm opportunities is the topic of this study. This paper summarizes an attempt to assess how the off-farm labor supply of farm household members is affected by changes in off-farm wage rates, the average returns to on-farm labor, and the household's nonearned income. More details can be found in Smith (1978).

Objectives of the Study

This has two objectives. The first is to examine the importance of off-farm income[1] as a component of farm household income in Laguna, the Phillippines. Analysis of variance procedures are employed to evaluate how off-farm income and selected farm and family characteristics are assoicated with off-farm work.

The second objective is to explore the main economic and social factors which determine the off-farm labor supply by the small-farm husband and wife. Multiple regression models are employed to evaluate how returns to labor, nonearned income, and theoretically determined household characteristics affect the family's decision regarding off-farm labor supply of the husband and wife.

Hypotheses to be Tested

The hypotheses to be tested in this study are derived from a model of household economics. They are as follows:

1. The allocation of the farm husband's time to off-farm work is:
   a) positively related the the stock of farm machinery per hectare, the number of children under seven years of age, the number of children between the ages of seven and fifteen, and the number of household members older than fifteen years of age, cet. par., and

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[1]Off-farm employment and earnings in this study refer to the time worked and income received from activities other than those on the farm of residence. Thus, work as hired labor within the agricultural sector is considered as "off-farm employment."

b) negatively related to the husband's effective on-farm wage rate, the nonearnings income of the family, farm size, and size of the home dwelling, cet. par.

2. The allocation of the farm wife's time to off-farm work is:

a) positively related to the stock of farm machinery per hectare, and the number of household members older than fifteen years of age, cet. par.,

and

(b) negatively related to the wife's effective on-farm wage, the nonearnings income of the family, farm size, the size of the home dwelling, and the number of children under seven years of age, cet. par.

3. The change in the wife's off-farm labor supply for a given change in her off-farm wage rate is expected to be greater than the change in the husband's off-farm labor suppply for a similar change in his off-farm wage rate, cet. par.

4. The change in the wife's off-farm labor supply for a given change in the husband's off-farm wage rate is expected to be greater than the change in the husband's off-farm labor supply for a similar change in the wife's off-farm wage rate, cet. par.

Organization of this Paper

This paper is organized as follows: The theoretical foundation for this empirical study is presented in the following section. Beginning with the simple work-home time model, a model of family labor supply is developed to explain the allocation of time between farm work, off-farm

work, and home time. A discussion of the methodology employed is presented in the third section, and the results of the analysis are presented in the fourth section. A summary of the findings and policy proposals are presented in the last section.

THE THEORY OF OFF-FARM LABOR SUPPLY

Recent studies of the theory of labor have emphasized that labor force behavior can be adequately understood only by analyzing factors which determine the household's allocation of members' time to market and home activities (Mincer, 1962; Becker, 1965; Gronau, 1973; Evenson, 1976; Rosenzweig, 1977). The theory views the household as a production/consumption unit using purchased goods (X_{zi}) and nonmarket home time (T_{zi}) of household members to produce commodities (Z_i) consumed by the family. The theory of household economics as applied to off-farm labor supply of farm husbands and wives is dependent upon four assumptions: the family has a utility function; the family behaves as though it is a utility maximizer; the family has an accurate perception of its nonmarket resource value; and, family members do not face institutional constraints limiting their allocation of time to market activites.

It has been argued that people in developing countries, especially those in subsistence agriculture, live outside the market economy. Therefore, relative scarcity signals provide inaccurate or poorly transmitted information to households. Thus, even if the family behaves as though it was maximizing utility, the constraints on actual behavior are not related to the factors in the larger community as economic models of household behavior have suggested. Butz (1976) and Evenson (1976) recently challenged this view. Butz believes that families in developing countries are linked to both product and factor markets through a richer network of participation than many families living in

more developed countries. Evenson notes there are cultural factors in value perception. The fact that households devote somewhat more resources to religious or communal activities does not indicate they are unable to maximize household utility. He also argues that rural labor markets exist, and that there are sufficient contacts between the family and the market to develop an appreciation of household members' non-market time.

The assumption regarding institutional constraints is also often disputed. The neo-classical assumption of household economics denies the existence of institutional constraints, particularly underemployment, and holds that the household is able to allocate the family members' time to maximize household utility. The fact that standard measures of underemployment rely upon a culturally biased concept of a forty hour work week tends to support the neo-classical position. A structural economist, on the other hand, holds that institutional constraints limit the ability of household members to allocate their time to off-farm activities. This position, if valid, implies that the measure of off-farm labor supply--the time actually worked--is inappropriate due to the discrepancy between the time the household is willing to work and the time actually worked. Empirical studies which have examined labor market behavior of farm families (Boulier, 1976; Rosenzweig, 1977; Evenson, 1978; King, 1978; and Wu, 1978), however, indicate that models of household time allocation do apply to developing areas in the Philippines, India, and Taiwan. But due to the possibility of structural barriers, the empirical results may be interpreted as the minimum expected response.

A standard assumption of models examining multiple-job-holding by farm household members (Sexton, 1975; Huffman, 1976) is that the farm enterprise, unlike off-farm work, is subject to diminishing marginal physical and economic returns. Further assumptions regarding the farm enterprise include: the farm has a given stock of capital, land, labor, etc.; the farm production function is independent of off-farm time allocation; the household's planning horizon is a single time period; and the household demonstrates no overriding commitment to farming.

The One-Person Farm Household Model

It is useful to begin examining the household decision-making process with a one person household. Consider the situation of a farm operator whose primary occupation is farming as shown in Figure 1. The curve AHCD represents the opportunity set in farming (the budget constraint) which limits the production and consumption of home-produced Z-goods.[2] In the absence of secondary employment opportunities, the farm operator will move to the utility maximizing point H, such that he works DF hours on the farm and receives FH income with which to purchase X-goods. FO hours of possible work time are spent in home activities.

The introduction of off-farm employment with a constant hourly wage, BC, expands the operator's opportunity set to BJCD. It is assumed that the operator's primary employment is on the farm so the off-farm wage is below the hourly wage (average productivity) earned in farming

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[2] The curvature of the farm opportunity set reflects the assumption of diminishing marginal returns to labor.

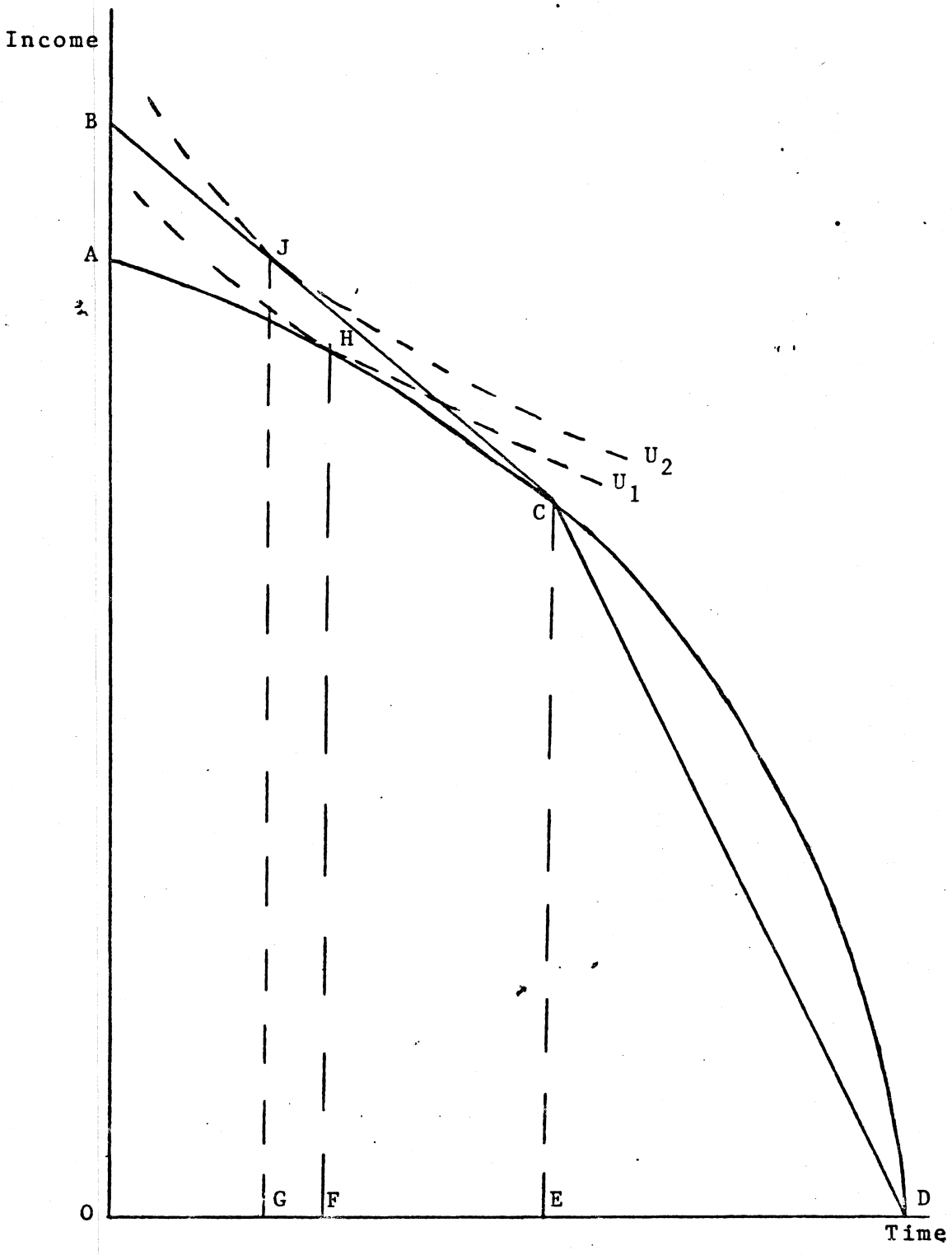

Figure 1: Multiple Job-Holding with Primary Job in Farming

(CD) for some initial period of time. The farm operator will continue to work solely on the farm as long as the marginal earnings received from farming exceeds the off-farm wage rate. However, when the off-farm wage rises above the marginal on-farm wage at point C, the farmer will be induced to transfer some time to off-farm work, holding all other factors constant. Thus, the operator moves to point J on the higher utility curve U_2, works DE hours on the farm and spends EG hours in off-farm employment. GO hours of home time are combined with the X-goods purchased with income GJ in the production of Z-goods.[3]

Next, assume an increase in the on-farm rate due to an increase in produce prices, the introduction of high yielding varieties, or an increase in farm mechanization. This effect can be shown by rotating the effective on-farm wage CD clockwise to C'D in Figure 2. The budget constraint facing the farm operator shifts upward allowing him to reach the higher utility curve U_3. There is no change in the opportunity cost of home time[4], and thus no substitution effect but an income effect. As long as home time is assumed to be a productive resource, the demand for home time will increase from GO to KO, and the total hours worked will fall from DG to DK. Since the effective farm wage has increased, farm work will increase from DE to DF, while hours worked off the farm will decline from EG to FK.

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[3] Barros (1976) argues that the farm operator due to tastes, non-pecuniary aspects, the hidden costs of employment, etc., may prefer on-farm work to such an extent that he establishes an asking wage above the current offered market wage. In such a case the operator will not work off the farm even though the offered market wage is higher than the marginal on-farm earnings.

[4] Since the farm operator is assumed to allocate his time so that the marginal value of on-farm labor equals the off-farm wage, the exogenous off-farm wage equals the effective on-farm wage and is the opportunity cost of home time.

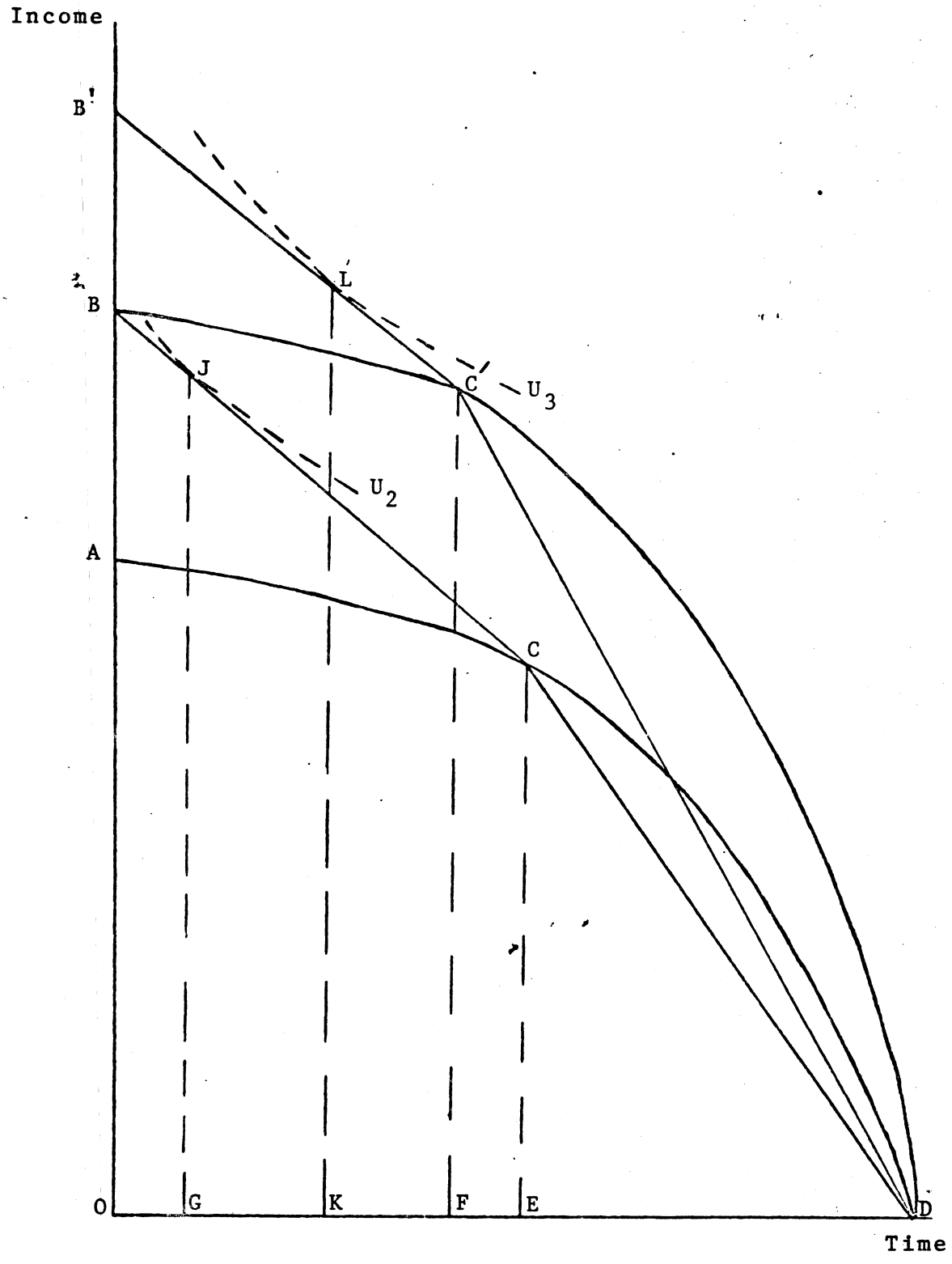

Figure 2 : Effect of a Change in the Farm Wage Rate on the Labor Supply of a Farm Operator.

Next, consider the effect of increasing the off-farm wage rate. This increase is shown in Figure 3 by a clockwise rotation of the wage rate from BC to B'C'. Again the farmer is able to shift to a higher level of utility, but it cannot be determined whether total labor supply will increase or decrease. The increase in off-farm wage increases the opportunity cost of home time leading to a substitution of work for home time. The income effect, on the other hand, increases demand for home time and reduces labor supply to the market. Thus, the net effect will depend on the relative magnitude of the income and substitution effects. A reallocation of time between farm and off-farm work is expected. As the off-farm wage increases, it is expected that the operator will reduce the time worked on the farm from DE to DF.

The impact of nonearnings income on time allocation has been analyzed by Kosters (1966), Bollman (1976) and Huffman (1976). The farm household may receive nonearnings income such as dividends, rents, transfer payments, etc., as shown by DA in Figure 4. In the absence of nonearnings income, the operator attains point J of utility curve U_2, working DE on the farm, EG off the farm, GO in home activities, and earning JG income. With nonearnings income, he is able to reach point Q on utility curve U_3, reducing off-farm work from EG to EH, and earning HQ income.

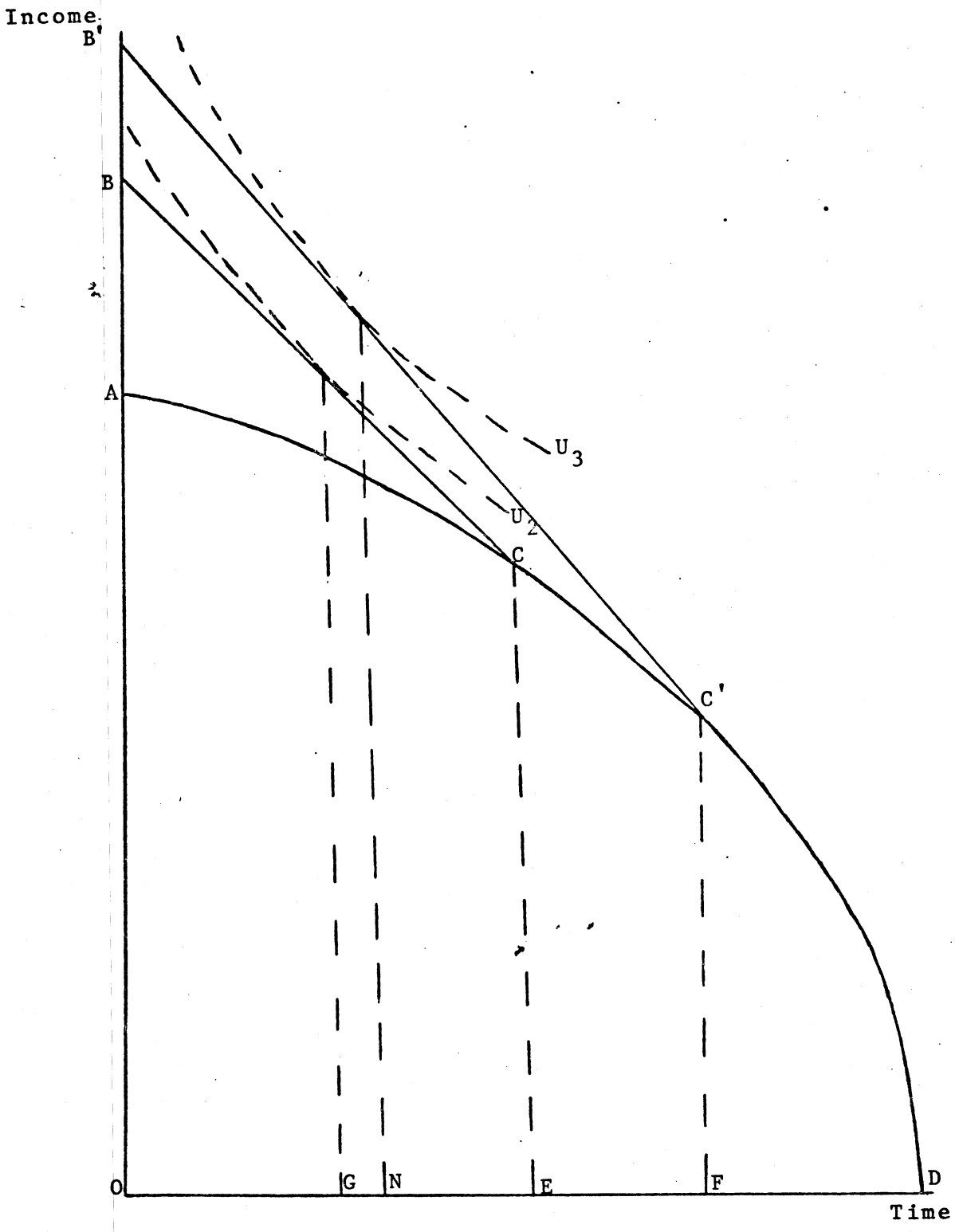

Figure 3: Effects of a Change in the Off-farm Wage Rates on the Labor Supply of a Farm Operators.

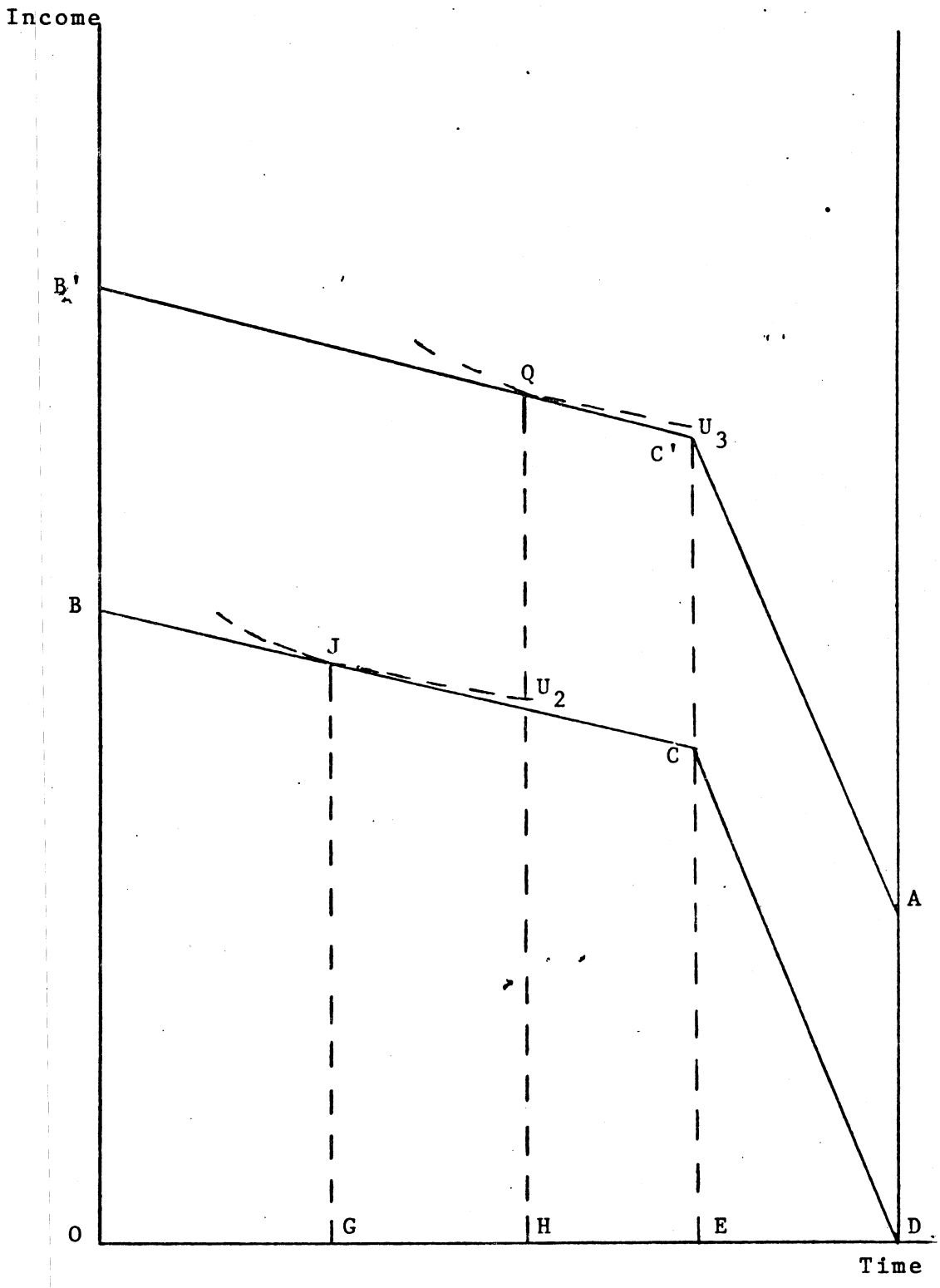

Figure 4: Effect of Nonearnings Income on the Labor Supply of a Farm Supply

The Multiple Person Farm Household Model

This section presents a multiple person household model where interaction among household members is considered. The family is assumed to maximize household utility by minimizing the cost of producing Z-goods within the household. This determines the amount of labor to be supplied to the market by each family member. Family members most efficient in converting purchased goods and home time into consumption commodities will tend to specialize in home production. Similarly, members with higher productivity or earning potential in the market place tend to specialize in labor force activities. While specialization is expected, household members may engage in more than one production activity. Assuming a two-person household, it is possible to combine both members' home time with purchased goods to produce home consumption goods and generate family utility. Thus, the household utility function becomes:

$$U = U(Z_h, Z_w) \text{ where} \qquad (1)$$

Z_h = home commodities produced by the husband, and

Z_w = home commodities produced by the wife

Following Becker (1965), it is assumed that the home production function has fixed coefficients represented as:

$$Z_i = f_i(T_{zi}, X_{zi}) \qquad i = h,w \qquad (2)$$

$$X_{zi} = g_i Z_i \qquad i = h,w \qquad (3)$$

$$T_{zi} = t_i Z_i \qquad i = h,w \qquad (4)$$

where:

X_{zi} = market goods used by person i in the production of Z_i.

T_{zi} = time used by person i in the production of Z_i.

g_i = amount of market goods used per unit of Z_i producted by person i, and

t_i = amount of time used per unit of Z_i by person i.

The inverse of g_i and t_i is the marginal productivity of market good inputs and time inputs, respectively, in the production of Z. For a given individual, these marginal productivities are constant though they may vary across household members. The assumption of fixed proportions allows no substitution between goods and time in production of a given commodity at one point in time, but substitution between different commodities is allowed since a fixed proportion utility curve has not been assumed.

The two person household maximizes utility subject to an income constraint, time constraints, and the home production function constraints. Equations 2, 3, and 4 presented the home production constraints for the husband and wife. The time constraints are:

$$T_O = T_{FW} + T_{MH} + T_{zh} \quad (5)$$

$$T_O = T_{FW} + T_{MW} + T_{zw} \quad (6)$$

where:

T_O = total time available to the husband (wife),

T_{FH} = time spent by the husband at farm work,

T_{MH} = time spent by the husband at off-farm work,

T_{zh} = time spent by the husband at home production,

T_{FW} = time spent by the wife at farm work,

T_{MW} = time spent by the wife at off-farm work and,

T_{zw} = time spent by the wife at home production.

Since time worked on the farm is endogenous to the system, it is possible to assume that wage rates earned by an individual household member are equal at the margin. If both husband and wife devote 24 hours per day to work and assuming equilibrium wage rates, the time constraints found in equations5 and 6 become the full income constraint represented as:

$$PX_h + PX_w + W_{H*}T_{zh} + W_{W*}T_{zw} = (W_{H*} + W_{W*})\ T_O + V \qquad (7)$$

where:

P = the unit price of X_h and X_w, respectively,

W_{H*} = the husband's equilibrium wage rate

W_{W*} = the wife's equilibrium wage rate, and

V = the household's nonearnings income.

If the home production values for T_{zh}, T_{zw}, X_h, and X_w are substituted into equation 7, equation 8 is obtained:

$$Pg_hZ_h + Pg_wZ_w + W_{H*}t_hZ_h + W_{W*}t_wZ_w = (W_{H*} + W_{W*})\ T_O + V \qquad (8)$$

Rearranging:

$$(Pg_h + W_{H*}t_h)Z_h + (Pg_w + W_{W*}t_w)Z_w = (W_{H*} + W_{W*})\ T_O + V \qquad (9)$$

where:

$(pg_h + W_{H*}t_h)$ and $(pg_w + W_{W*}t_w)$ are the full prices of Z_h and Z_w, respectively. These are not market prices since Z's are not traded in the market. These prices represent the marginal cost of producing Z_h and Z_w, and are assumed to be constant during the single period of the study.

The family maximizes the utility function presented in equation 1 subject to the budget constraint given in equation 9. Thus criteria can be developed by which the household allocates the members' time to various activities. Following the conventional technique for constrained

maximization, the following Lagrangian function is set up:

$$L = U(Z_h, Z_w) - \lambda[(Pg_h + W_{H*}t_h)\ Z_h + (Pg_w + W_{W*}t_w)\ Z_w - T_O\ (W_{H*} + W_{W*}) + V] \tag{10}$$

where:

Z_h, Z_w, T_{FH}, T_{MH}, T_{FW}, T_{MW}, and λ are endogenous variables and P, g_h, g_w, t_h, t_w, W_{H*}, W_{W*}, and V are exogenous to the decision maker. The first order conditions for maximization are:

$$U_{Z_h} - \lambda(Pg_h + W_{H*}t_h) = 0 \tag{11}$$

$$U_{Z_w} - \lambda(Pg_w + W_{W*}t_w) = 0 \tag{12}$$

$$-[(Pg_h + W_{H*}t_h)\ Z_h + (Pg_w + W_{W*}t_w)\ Z_w + (W_{H*} + W_{W*})\ T_O + V] = 0 \tag{13}$$

where:

λ is the Lagrangian multiplier, and U_{Z_h} and U_{Z_w} are the first derivatives of the utility function with respect to Z_h and Z_w.

From these first order conditions, the familiar marginal rate of substitution in consumption is obtained:

$$\frac{U_{Z_h}}{U_{Z_w}} = \frac{Pg_h + W_{H*}t_h}{Pg_w + W_{W*}t_w} \tag{14}$$

The marginal rate of substitution in consumption between commodities produced by the husband and wife equals the ratio of the full prices. If the price of commodities produced by the husband were to increase (due to an increase in his wage rate or a decrease in his efficiency in converting goods and time into home commodities), with no change in the price of household commodities produced by the wife, one would expect an increase in consumption (hence production) of commodities produced by the wife and a decrease in the consumption (and production) of commodities produced by the husband. The extent

of substitution depends upon the elasticity of substitution in consumption between these commodities in the family's utility function.

The first order conditions, derived above, represent the structural equations for the theoretical model used in this study. This set of equations may be solved for Z_h, Z_w, and to give the following reduced form equations:

$$Z_h = f_1 (W_{H*}, W_{W*}, V, P, g_h, g_w, t_h, t_w) \quad (15)$$

$$Z_w = f_2 (W_{H*}, W_{W*}, V, P, g_h, g_w, t_h, t_w) \quad (16)$$

Given this theory developed above, the effect of ceteris paribus changes in the independent variables can be derived by examining the expected effect on demand for the household members' home and farm time. These expected effects are summarized below.

Changes in Off-farm Wage Rates

The effect of an increase in the husband's or wife's own wage on own off-farm labor supply cannot be determined theoretically. The terms possess the usual income and substitution effects associated with the Slutsky equation. The relative magnitudes of these two effects will determine the sign of the total effect. An increase in the off-farm labor supply if the husband's and wife's time are more substitutable than complementary in home and farm production activities.

Changes in the On-farm Wage Rates

An increase in a household member's effective on-farm wage is expected to cause a decrease in the individual's off-farm labor supply. An increase in the spouse's on-farm wage is expected to have a positive effect if the husband's and wife's time are substitutes in farm production, and negative if they are complementary.

Changes in Nonearned Income

The effects of changes in the household's nonearned income cannot be predicted by mathematical properties alone. If it is assumed, however, that the home time of the husband and wife are productive resources and the home commodities they produce are normal goods, then an increase in nonearned income is expected to reduce the off-farm labor supply of both the husband and wife.

Environmental Variables

Environmental variables are not expected to directly affect wage and income elasticities, but were included in this research to control for the effects of farm and home characteristics on the off-farm labor supply. Since these variables were not included in the theoretical model, it is not possible to predict the expected relationships from the model developed. It is possible, however, to make some predictions based on related economic theory and other empirical research.

Farm Characteristics

A strict interpretation of the theory of household economics suggests that farm characteristics are determined simultaneously with the family's off-farm labor supply decisions. Yet, with the Philippine emphasis on farm size and level of farm mechanization is believed to be reasonable. Furthermore, these variables are normally not subject to wide variation in a single time period, and thus are partially predetermined.

An increase in farm size, should have a negative effect on time

allocated to off-farm employment since a larger farm generally requires more total labor input, households have greater potential for achiveing desired income levels through farm work, and social pressures, including fear of land reform, encourage the use of all available land. Mechanization, on the other hand, is expected to have a positive effect on off-farm labor supply, due to the possible substitution of machinery for family labor.

Home Characteristics

No direct measure of home productivity was included in the study. Other researchers (Leibowitz, 1972; Bloch, 1974) have attempted to account for home productivity by incorporating variables for number and age structure of children because the productivity of both the husband and wife is expected to be influenced by family structure. Four variables were used in this study to control for home productivity. They are the number of children under seven years of age, the number of children between the ages of seven and fifteen, the number of children living in the household older than fifteen years, and the size of the house dwelling. An additional young child should induce the wife to devote more time to home prodution and less to farm and off-farm work, while the husband may increase off-farm work to substitute for the wife's loss of income. As children grow older, they become more goods intensive and less time intensive. This increases the demand for purchased goods and the corresponding work effort by husband and wife. As children approach adulthood, they cease being consumption commodities and begin to enter the household's time allocation decision process. It

is hypothesized that children first engage in home and farm activities, then enter the off-farm market as possible substitutes for parents' market time. Children may begin to substitute for the wife's farm and off-farm time input at an earlier age than for the husband because of an expected lower earning potential of the wife.

The size of the home dwelling, like farm size, is in fact endogenous to the theoretical model, but is influenced more by family life cycle than temporal values of members' time. As house size increases, the off-farm labor supply of both husband and wife should decline due to the time-intensive nature of home maintenance.

To summarize, the theoretical model including environmental variables was specified as:

$$T_{MH},\ T_{MW},\ = f(W_{FH},\ W_{MH},\ W_{FW},\ W_{MW},\ V,\ F,\ M,\ C_{06},\ C_{715},\ O,\ S) \qquad (17)$$

where:

T_{MH} = Husband's time allocated to off-farm work,

T_{MW} = Wife's time allocated to off-farm work,

W_{FH} = Effective on-farm wage rate of husband,

W_{MH} = Off-farm wage rate for husband,

W_{FW} = Effective on-farm wage rate of wife,

W_{MW} = Off-farm wage rate for wife,

V = Nonearned income of household,

F = Size of farm operating unit,

M = Value of farm machinery per hectare,

C_{06} = Number of children younger than 7 years of age,

C_{715} = Number of children between ages 7 and 15,

O = Number of children older than 15 years, and

S = Size of home dwelling.

THE EMPIRICAL MODEL

This section describes how the data were compiled to construct the variables for the empirical model. The variables are summarized in Table 1 and are described in detail below.

The data employed in this study were a subset of the "Laguna Household Resurvey" collected by Robert E. Evenson and colleagues in the Philippines. The data were collected in the months of April and May, 1977. The original sample was randomly selected from 26 rice production barrios in the Province of Laguna by the Unversity of the Phillipines at Los Banos in 1963 and 1968. Information on 244 rice producing households was obtained in the 1977 resurvey. Households were excluded if either spouse was not present, if the household no longer operated a farm, if the operator's age was greater than 65 years or if the data were incomplete. This reduced the sample to 188 observations for this study.

Off Farm Labor Supply

Previous studies have used a variety of dependent variables to measure various dimensions of labor supply: a zero-one variable indicating whether or not one individual is in or out of the labor force (Cain, 1966; Bowen and Finegon, 1969); total hours worked during the year (Kosters, 1966; Leuthold, 1968; Heckman, 1971; Sexton, 1975); and a continuous variable that includes time employed and time unemployed (Kalachek & Raines, 1970; Garfinkel, 1973). Conceptually, the preferred variable is one which reflects the long-run or equilibrium allocation of time. A measure should be employed which avoids seasonality in

Table 1: A Summary of the Empirical Variables to be Used in the Analysis

Variable Used	Symbols	Units	Descriptions	Expected Effect on T_{MH}	Expected Effect on T_{MW}
Off-Farm Labor Supply of Husband	T_{MH}	Days	Total Days Worked by Husband in Wage Labor and Family Side Business		
Off-Farm Labor Supply of Wife	T_{MW}	Days	Total Days Worked by Wife in Wage Labor and Family Side Business		
Off-Farm Wage Rate of Husband	W_{MH}	P/Day	Imputed Using the Human Capital Approach	?	?
Off-Farm Wage Rate of Wife	W_{MW}	P/Day	Imputed Using the Human Capital Approach	?	?
On-Farm Wage Rate of Husband	W_{FH}	P/Day	Weighted Daily Replacement Cost of Husband in Agriculture	-	?
On-Farm Wage Rate of Wife	W_{FW}	P/Day	Weighted Daily Replacement cost of Wife in Agriculture	?	-
Nonearnings Income	V	P/Day	Includes the Returns to Farm Capital Net Rental Income, and Income Received from Non-Household Members	-	-
Farm Size	F	Hectares	Amount of Land Operated and Area of Operation	-	-
Stock of Farm Machinery	M	P/Ha.	The Capital Intensity per Hectare of Farm Operation	+	+
Younger Children	C_{06}	Persons	Number of Pre-school Children in the Household	+	-
Other Children	C_{715}	Persons	Number of Children Present in the Household between the ages of 7 and 15	+	?
Other Older Household Members	O	Persons	Number of Household Members other than Husband or Wife who are Older than 15	+	+
Home Size	S	m^2	Size of Living Area	-	-

employment and, since wage rates are exogenous factors, a labor supply variable is required which does not affect wage rates. To avoid the problems associated with a variable too short or too long in duration, the Philippines data refered to the household's experience from April 1, 1976 to April 1, 1977.

For individual cross-section data, the dichotomous labor force participation variable is generally the least desirable measure. If the measure is whether a person is in or out of the labor force during the week of interviewing, it will miss all persons in the labor force at other times of the year. This measure also fails to provide information regarding the amount of time offered.[5] Other measures of labor supply are total hours, days or weeks worked during the year. The weeks variable has an advantage over the days and hours variables in that it is less likely to be subject to response error. Total hours worked, however, is conceptually more desireable since people can adjust their labor supply by varying the munber of hours worked per day or week. While the Philippine data do not include this variable, they do include the number of days worked off the farm per year.[6] This variable does not provide the richness of information of hours worked but the probability of response error is much lower.

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[5] There is also the problem of heteroscedasticity associated with dichotomous dependent variables in ordinary least squares regression models (Kmenta, 1971).

[6] Theoretically the dependent variable should include the time spent at home producing goods for sale in the market, i.e., the cottage craft industry. Due to data limitiations, however, off-farm labor supply was considered only as the number of days spent working for wages (including the days worked on other households' farms) and in side businesses. While no husbands engaged in side business activities, 7 of the 23 wives reporting off-farm labor activities were engaged in some side business activities.

An important concept relevant to off-farm labor supply is that the labor supply decision is a function of two separate (but interrelated) decisions: a decision about whether to participate in the off-farm market, and a decision regarding the amount of time allocated to the off-farm market once the decision to work has been made (Sexton, 1975; Barros, 1976). Statistically, there apears to be no single preferred technique integrating labor force participation with time worked. The difficulty with the two-state procedures employed by Kalachek and Raines (1970) and Boskin (1973) is that the disturbance terms associated with the estimates of labor force participation and time worked may be contemporaneously correlated. Another technique is to record zero values for the time worked by individuals who are not in the labor force. This avoids the problem of contemporaneous correlation but may introduce a truncation bias because individuals who have tastes against off-farm work may prefer to work less than zero hours at a given wage.

Given the lack of any compelling arguments for using the two-stage procedure, the simpler approach of assigning zero values for days worked by husbands and wives not working in the off-farm labor force was selected for this study. The problem of truncation was addressed by using Tobit procedures which employ maximum likelihood techniques to estimate the coefficients of the explanatory variables.

Off-Farm Wage Rages

The off-farm wage rate variables used in this study were peso earnings per day paid in cash and kind. Peso earnings for both the husband and wife were in modified gross form. That is, the wage rate considered

deducts the commuting costs (both direct and the indirect cost of time), but does not adjust for taxes. Modified gross earnings per day were computed by multiplying the number of days worked at wage labor times income (payment received minus direct commuting costs) received per day, plus the number of days worked in the household's side business times the individual's business replacement cost per day.[7] This sum was divided by the number of days spent per year in wage labor, commuting, and business to obtain a daily wage for those persons who worked off the farm. Daily wages were then regressed against education and experience, as specified by Becker (1964) and Leibowitz (1972), to obtain a wage measure for all household members. Operationally, it is necessary to impute a wage rate only for those persons who do not work off the farm. For those with off-farm work, the modified gross daily earnings estimate may be used. There is some risk, however, in using this approach as several authors have noted (Greenberg, 1972; Bloch, 1973; Sexton, 1975). The problem concerns the use of the dependent variable of the labor supply equation to construct a wage variable. If the household member spent more (less) time in off-farm work than actually reported, the average daily earnings figure would overestimate (underestimate) the

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[7] Replacement cost is defined as the price one would have to pay to hire someone to perform a particular task. As such, it is a proxy for the marginal value of one's time or wage rate in those activities in which the individual is not paid by another. Due to the construction of the question, these values may tend to overestimate the marginal value of one's time by reflecting the supply side of the hired labor market. A survey of the data, however, revealed that the replacement cost varied by activity and individual, and in general was 5 to 7 pesos lower than the corresponding hired labor wage.

wage rate received from off-farm work. These measurement errors will consequently introduce a negative bias into the relationship between labor supply and the off-farm wage rate (DeVanzo et al., 1973). This problem can be avoided by utilizing an inputed off-farm wage for all persons whether or not they actually worked.

Farm Wage Rates

The preferred measure of the on-farm wage rate is the marginal return to the individual household member's labor input in the farm production function. One method of approximating this value is to impute a return to the physical inputs employed on the farm and subtract this amount from net farm income to obtain a residual estimate of the returns to labor (Tyrchniewicz & Schuh, 1969). This procedure could not be employed in this study due to a lack of adequate information concerning farm input use.

Other authors (ex. Sexton, 1975) Huffman, 1976) have relied upon net farm income divided by the number of hours worked on the farm as a proxy for the on-farm wage rate. This measure not only fails to consider the cases in which more than one household member works on the farm, but also gives the average rather than the theoretically preferred marginal returns to on-farm labor. A further problem concerns simultaneity. Since time worked on the farm, the denominator, is determined simultaneously with the time worked off the farm, one may expect a baised relationship between the on-farm wage and off-farm labor supply.

The on-farm wage rate measure employed in this study was the individual's weighted daily farm replacement cost (see footnote 7).

This is an estimate of the daily wage the individual would pay hired labor to replace him (her) in a given activity (rice cultivation, coconut cultivation, other crop cultivation, or livestock care). The variable is weighted by the amount of time the individual spends in that activity. While this variable may overestimate the marginal value of one's time in a particular activity due to interaction with supply in the hired labor market and the individual's perception of wage rates as derived from off-farm work experience, it is a close proxy for the household member's perception of the value of his time.

Nonearnings Income

The main purpose of this variable is to measure the income effect of a change in the wage rates represented by a parallel shift of the budget line in the goods-time space (Figure 4). Since the required variable should simulate a parallel shift of the budget constraint, it must not have an effect on any of the wage rates. This variable should exclude income from any source, such as government transfer payments, which have an implicit tax associated with them. Also the nonearnings income variable must not be related to current labor decisions. This excludes such income as unemployment benefits, receipt of which is conditioned on the person not being at work. It is also inappropriate to include transitory income, since people can be expected to react differently to such changes in income compared to perceived permanent income changes.

The appropriate variable for measuring the income effect is one not influenced by the current wage rates of the husband and wife or by their

current labor supply. It should include the returns to financial assets owned by the family and inputed returns to nonfinancial assets (e.g., buildings, equipment, land). Rental income and transfer income from private sources should also be included. The actual components of nonearnings income in this study include: the imputed returns to farm capital, net rental income, income received from non-household children, and income received from other non-household members. Theoretically, the measure should also include the returns to land and home value; however, these variables were found to be unacceptable due to response error.

Environmental Variables

The environmental variables employed to control home and farm variation were found within the data and required minimal manipulation. The number of children in each age group was obtained by totaling the number of household members born in the corresponding years. The size of the home dwelling was measured in square meters, while farm size was measured in hectares. Farm mechanization was measured as the value of machinery stock per hectare.

EMPIRICAL RESULTS

Descriptive Analysis

This section provides descriptive information about the sample households to show the importance of off-farm earning, and to help interpret the regressions results which follow. For descriptive analysis, the sample households were divided into four types: type 1 households in which neither the husband nor the wife work off the farm, type 2 in which only the husband works off the farm, type 3 in which only the wife works off the farm, and type 4 in which both the husband and wife work off the farm.

Table 2 reports earnings and income for the households. For the entire sample, off-farm earnings represented 13.1% of total family income. Farm earnings accounted for another 82.4% and other receipts accounted for the remaining 4.5%. Off-farm earnings are an important component of total family income for housholds where one or both spouses work off the farm.[8] Earned off-farm income was 21% of net household income for families in which only one spouse worked off the farm, and nearly 40% for those in which both the husband and wife worked off the farm.

An examination of the F-ratio for net farm income leads to a rejection of the hypothesis that the mean value of this characteristic varies significantly across household types. Yet, where both the husband and

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[8] This trend is expected due to the greater time allocated to off-farm employment of the households assigned these classifications.

Table 2: Mean Earnings Values by Type of Household, FHDO-Baskinas Sample Lagona, the Philippines, 1977

Characterstic	Population Mean	Type of Household[a/] (1)	(2)	(3)	(4)	F-Ratio[b/]
No. of Observations[c/]	188	127	38	13	10	
Off-Farm Earnings[d/]						
By Husband	473.21	0.0	1,361.32	0.0	3,486.76	13.997***
By Wife	118.96	0.0	0.0	1,173.30	651.77	58.978***
By Children	705.87	895.08	285.96	1,291.06	54.04	1.286
By Household	1,298.04	895.08	1,647.28	2,464.36	4,192.57	0.811
Net Farm Income	8,181.75	9,012.77	6,141.86	8,789.64	5,344.55	0.962
Net Household Income	9,934.74	10,353.50	8,033.21	11,762.45	10,513.92	1.294
$\frac{\text{Net Farm Income}}{\text{Net Household Income}}$ [e/]	0.824	0.871	0.765	0.747	0.508	0.328
$\frac{\text{Earned Off-Farm Income}}{\text{Net Household Income}}$	0.131	0.086	0.205	0.210	0.399	0.042

[a/] The households are classified as follows: 1 = neither husband nor wife work off the farm; 2 = husband works off-farm, wife does not; 3 = husband does not work off-farm, wife does; 4 = both husband and wife work off-farm.

[b/] $F = \frac{\text{Between Groups Mean Square}}{\text{Within Groups Mean Square}}$ the degrees of freedome are 8 and 184 for the numerator and denominator respectively, * = significant at the 0.10 level; ** = significant at the 0.05 level; *** = significant at the 0.01 level.

[c/] These are not mean values, but the actual number of observations in each category.

[d/] All earnings and income reported are in Philippine Pesos; in 1977, 7 P = 1 U.S. Dollar.

[e/] Net farm income is defined as the value of the household's share of farm sales plus home consumption minus the household's share of farm operation costs.

wife work off the farm, the mean net farm income is considerably lower than when the husband does not work off the farm. Mean farm income is found to be the highest when neither spouse works off the farm, and only slightly lower when the wife enters the off-farm market leaving the husband and children to maintain the farm.

Net household income also does not vary significantly across household types. Those households with the highest net family incomes are those in which the wife works off the farm. This association may be misleading, however, due to the relatively greater contribution of earnings by the children and husbands in these households. Those households in which only the husband works off the farm report the lowest net household income.

Surprisingly, off-farm earnings by children are a major contributor to the household's total off-farm earnings. For all households, children earn 54.4% of the income received from off-farm employment. This result suggests that it may be useful to include[9] earnings of children in models to explain behavior of parents. Data limitations prevented such a formulation however. The mean value of off-farm earnings by children was found to vary greatly. Part of the variation may be explained by the age of children employed. Another possible

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[9] Children were excluded from the regression analysis due to the fact that the children's wage rate was recorded as an average value for all children employed off the farm. Thus, if only one child worked off the farm, or the wage rates for all children were nearly equal, the children's average wage may be expected to be a significant determinant of household time allocation. On the other hand, if there is a disparity in the children's wage rates, the average wage will not reflect the earning potential of those children who are believed to be substitutes for the husband's and wife's time.

explanation is that children tend to work a greater number of days off the farm and receive more earnings when the husband does not work off the farm (see Table 3).

In summary, off-farm earnings are an important component of household income among Laguna farm families. While mean farm incomes appear to vary substantially across household types, mean net household income did not vary so greatly. This implies that the importance of off-farm earnings increases as net farm income declines, and depends as much upon the children's off-farm work effort as that of the husband and wife.

The mean values of farm and off-farm wage rates and the number of days worked off the farm are presented in Table 3. Theory states that the individual will allocate time to off-farm employment when the off-farm wage rises above the daily on-farm wage. The data in Table 3 support this hypothesis for farm husbands. The on-farm replacement wage (the proxy for daily farm earnings) is found to be highest and significantly greater than the imputed off-farm wage for those husbands who do not work off the farm, while the off-farm wage is greater for those husbands who work off the farm. The data for wives, on the other hand, do not appear to suport the theoretical model as well. It would appear that wives who work off the farm are not maximizing household income. Since the daily on-farm replacement cost for wives who worked off the farm was greater than that of their spouses, one would expect the wife to work on the farm while the husband engaged in off-farm employment. Upon closer examination, however, it was found that the sole on-farm activity of many of the wives who worked off the farm was the care of

TABLE 3: Mean Values of Wage and Days Worked Off-Farm by Type of Household, FHDO-Baskiñas Sample, Laguna, The Philippines, 1977

Characteristic	Population Mean	Type of Household[a/] (1)	(2)	(3)	(4)	F-Ratio[b/]
No. of Observations[c/]	188	127	38	13	10	
Days Worked Off Farm						
By Husband	28.67	0.0	110.32	0.0	105.40	48.458***
By Wife	17.23	0.0	0.0	183.04	77.30	75.629***
By Children	91.70	101.31	74.68	111.08	15.80	1.179
Wage Rates						
Husband's Daily On-Farm Replacement Cost	27.42	29.93	22.31	28.03	15.46	0.007
Husband's Imputed Off-Farm Wage	19.53	19.37	19.70	19.57	21.01	1.499
Wife's Daily On-Farm Replacement Cost	13.47	12.73	9.60	30.50	16.06	2.582*
Wife's Imputed Off-Farm Wage	5.45	5.45	5.46	5.56	5.14	0.240
Typical Child's Observed Off-Farm Wage	7.70	8.84	3.83	11.62	3.42	1.653

[a/] The households are classified as follows: 1 = neither husband nor wife work off the farm; 2 = husband works off-farm, wife does not; 3 = husband does not work off-farm, wife does; 4 = both husband and wife work off-farm.

[b/] $F = \frac{\text{Between Groups Mean Square}}{\text{Within Groups Mean Square}}$, the degrees of freedom are 8 and 184 for the numerator and denominator respectively. * = significant at the 0.10 level; ** = significant at the 0.05 level; *** = significant at the 0.01 level.

[c/] These are not mean values, but the actual number of observations in each category.

livestock. Given the possibility of rapidly diminishing returns to labor for livestock care, at the margin the wife may maximize her time allocation by working off the farm.

Although this study does not explicitly consider the determinants of time allocated by children, there appears to be a positive relationship between childrens' wages and the number of days they worked off the farm.[10] Future studies using the model of household economics may extend it to incorporate the time allocation of children.

Other characteristics which may influence the off-farm labor supply are presented in Table 4. It was found that farm size varies significantly across household types. Households in which neither the husband nor the wife work off the farm have the highest mean size of 2.73 hectares. Households in which both the husband and wife work off the farm have a mean size of 1.43 hectares. The households in which only the wife works off the farm have a mean size of 2.18 hectares, and those in which only the husband works off the farm have a mean size of 1.88 hectares. Thus, as farm size decreases first the wife, then the husband work off the farm.

The value of farm machinery was included as a proxy for the capital intenstiy of the farm operation. It was hypothesized that as the farm operation becomes more capital intensive, more time will be allocated to off-farm employment so long as the marginal returns to on-farm labor are held constant. The data in Table 4 show that while this relationship is true for households in which only the husband works off the farm, an

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[10] The variable corresponding to the typical child's wage was calculated at the expected value for all children who worked off the farm.

TABLE 4: Mean Values of Selected Farm, Home and Individual Characteristics by Type of Household, Laguna, the Philippines, 1977

Characteristics	Population Mean	Type of Household (1)	(2)	(3)	(4)	F-Ratio[b/]
No. of Observations[c/]	188	127	38	13	10	
Farm Characteristics						
Farm Size (Ha.)	2.44	2.73	1.88	2.18	1.43	2.520*
Value of Machine Stock per Ha.	1,678.27	1,704.61	2,036.27	1,398.87	395.58	0.743
Home Characteristics						
Size of Home (m^2)	102.20	104.60	90.03	153.62	52.40	1.998
No. of Children under 7 years of age	0.62	0.52	0.95	0.23	1.10	3.773**
No. of Children between the ages of 7 and 15	2.06	1.95	2.42	2.00	2.20	0.750
No. of Household members over 15 years	2.32	2.12	2.97	3.00	1.30	0.764
Total Number of Household Members	7.00	6.59	8.34	7.23	6.60	1.461
Individual Characteristics						
Husband's Age	49.90	51.39	45.68	52.31	44.70	5.751***
Wife's Age	46.83	48.42	42.00	49.46	41.90	6.647***
Husband's Education	3.82	3.64	4.24	3.38	5.11	1.409
Wife's Education	3.84	3.64	4.39	4.08	3.70	0.805

[a/] The households are classified as follows: 1 = neither husband nor wife work off the farm; 2 = husband works off-farm, wife does not; 3 = husband does not work off-farm, wife does; 4 = both husband and wife work off-farm.

[b/] $F = \frac{\text{Between Groups Mean Square}}{\text{Within Groups Mean Square}}$, the degrees of freedom are 8 and 184 for the numerator and denominator respectively. * = significant at the 0.10 level; ** = significant at the 0.05 level; *** = significant at the 0.01 level.

[c/]

inverse relationship was found between farm capital and time worked off the farm by the wife. Those households in which both the husband and wife work off the farm have less than one fourth the value of machinery stock per hectare of the entire sample. This fact plus the relative importance of off-farm earnings suggests they may be regarded as "part-time farm households," i.e., they remain engaged in farm production but may consider off-farm work as their primary employment.

The home characteristics included in this study were the size of the home dwelling and the age and structure of family composition. Considering first the size of the home dwelling, it appears as though the predicted negative relationship holds for husbands, but not wives. The number of household members over fifteen years of age is greatest when one spouse works off the farm. There does not appear to be a significant relationship for children between the ages of seven and fifteen and time worked off the farm. The number of young children is greatest for those households in which only the husband works off the farm, and the lowest for those households in which only the wife works off the farm. The relatively higher number of younger children associated with type 4 working wives appears contrary to theory. This trend may be explained by either the taste for work or the necessity of earning off-farm income.

Farm husbands who work off the farm are both younger and have more schooling than those who do not work off the farm. No such trends were found for farm wives.

In summary, the descriptive analysis reveals that off-farm earnings supplement net farm income for all household types. The importance of

off-farm earnings is substantially greater for those households in which at least one spouse participates in the off-farm labor market. Furthermore, it appears that the relationships predicted by theory are supported by the analysis of the characteristics of farm husbands. But the only relationship which appears as predicted for farm wives is the negative association with farm size. All other relationships appear ambiguous. These findings suggest that such factors as the taste for off-farm employment or opportunities to work off the farm may be more important that the wage, farm, and home characteristics in determining the wife's off-farm labor supply. The descriptive analysis also suggests that households in which both the husband and wife work off the farm may be considered as "part-time farm households," and that children are economically active in both farm and off-farm endeavors. This final finding implies that a potentially important factor explaining household time allocation could not be included in the regression analyses reported below.

Model Results

Estimation Procedures

The general form of the models employed were previously discussed. The specific forms are as follows:

$$T_{MH} = a_0 + a_1W_{FH} + a_2W_{MH} + a_3W_{FW} + a_4W_{MW} + a_5V + a_6F + a_7M + a_8C_{06} + a_9C_{715} + a_{10}O + {}_{11}S + U_1 \quad (18)$$

$$T_{MW} = b_0 + b_1W_{FH} + b_2W_{MH} + b_3W_{FW} + b_4W_{MW} + b_5V + b_6F + b_7M + b_8C_{06} + b_9C_{715} + b_{10}O + b_{11}S + U_2 \quad (19)$$

where:

T_{MH} = Time worked off-farm by husband,

T_{MW} = Time worked off-farm by wife,

W_{FH} = Daily on-farm replacement cost for husband,

W_{MH} = Off-farm wage rate for husband,

W_{FW} = Daily on-farm replacement cost for wife,

W_{MW} = Off-farm wage rate for wife,

V = Nonearned income of household,

F = Farm size,

M = Stock of farm machinery per hectare,

C_{06} = Number of children younger than 7 years of age,

C_{715} = Number of children between the ages of 7 and 15,

O = Number of children older than 15 years of age,

S = House size, and

U_i = Disturbance terms.

The regressions were designed to capture the two-dimensional nature of the off-farm labor supply decision by intergrating labor force participation with days worked. Household members who did not work off the farm were incorporated into the analyses with a zero value assigned for the number of days worked off the farm.

The estimation procedure employed is the regression model developed by Tobin (1958), commonly referred to as "Tobit" analysis. This procedure was employed to eliminate the problem of truncation bias discussed above. The Tobit procedure uses maximum likelihood techniques to estimate the coefficients of the explanatory variables. The likelihood function, when differentiated with respect to the unknown parameters, yields normal equations which are nonlinear in nature (Goldberger,

1964). Thus the use of an iterative procedure is necessary to find the maximum likelihood estimates of the regression coefficients.

Regression Results for Farm Husbands

The results obtained from fitting equation 18 to the data for farm husbands are found in Table 5. Results are presented for a model with wage and income variables, and another with farm and home characteristics included as control variables.

The Tobit procedure does not permit an analysis of the statistical goodness of fit (R^2) or the use of F-ratios to test the hypothesis that all coefficients are equal to zero. Instead, the Tobit procedure reports the log of the likelihood ratio, λ . For a large sample size, -2λ is distributed chi square with k degrees of freedom, where k is the number of explanatory variables other than the constant (Tobin, 1958). The test of significance using -2λ is analogous to an F-test of the hypothesis that all coefficients equal zero when ordinary least squares procedures are employed. The results of this test indicate that while the hypothesis cannot be rejected in the model with only wage and income variables, it can be rejected at the .10 level of significance for the model including environmental variables. It was found, however, that the model including only the wage and income variables is best able to predict both the probability of working off the farm and the mean number of days worked.

As shown in Table 5, an increase in the husband's off-farm wage rate is associated with a significant increase in the time allocated to off-farm employment. The elasticity of off-farm labor supply, calcu-

lated at mean levels of wages and days worked per year, averaged 3.43 for the two equations. This result implies that a 10 percent increase in the wage rate would generate a 34 percent increase in the number of days worked off the farm by farm husbands.[11]

The coefficient of the husband's on-farm wage, W_{FH}, was found to be positive, although not significantly different from zero, rather than negative as expected. This apparent paradox may be explained by analyzing the husband's on-farm replacement cost reported in Table 3. Type 2 husbands on the average worked off the farm 5 more days than Type 4 husbands, although their on-farm replacement cost was 7 pesos higher. Since Tobit procedures weight all observations by the probablity that the particular observation is associated with this subsample of husbands who work off the farm, an apparent positive relationship was detected. In another regression when ordinary least squares procedures were employed, the coefficient had the expected negative sign but again was not significant.

The amount of time allocated to off-farm work by farm husbands appears unrelated to the wage rates earned by the wives. The negative, though not significant, coefficient for the wife's on-farm replacement cost, W_{FW}, in both regressions suggests that the spouses' time may be complements in farm production. Such a relationship may be expected

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[11] This evidence suggests that Filipino farm husbands will respond to a change in their off-farm wage by supplying substantially more time to the off-farm market than their American counterparts. Sexton (1975) found the uncompensated wage elasticity for a sample of Illinois farm operators to be 1.71.

TABLE 5: Regression Coefficients and Related Statistics for Models of All Farm Husbands Using Tobit Procedures[a/]

Independent Variables	Regression (1)	Partial Elasticities	Regression (2)	Partial Elasticities
Intercept	-445.7642*** (2.62)		-435.9772*** (2.57)	
W_{FH}	0.2259 (0.49)	0.032	0.1824 (0.44)	0.030
W_{MH}	17.3997** (2.17)	3.072	18.5587** (2.33)	3.791
W_{FM}	-1.0457 (1.22)	-0.125	-0.6111 (1.78)	-0.084
W_{MW}	-1.5967 (0.11)	-0.079	1.6271 (0.12)	0.093
V	-0.0029 (0.22)	-0.017	0.0089 (0.62)	0.060
F			-38.7082*** (2.53)	-0.986
M			0.0031 (0.425)	0.049
C_{06}			39.9757** (1.92)	0.254
C_{715}			0.6574 (0.06)	0.014
0			8.8067*** (2.60)	0.215
S			-0.2420 (1.178)	-0.256
-2λ[b/]	6.242		29.171***	
Predicted Probability of Off-Farm Work	0.246		0.214	
Observed Frequency of Off-Farm Work	0.255		0.255	
Expected Mean of T_{MH}[c/]	27.1112		23.2276	
Observed Mean of T_{MH}	27.9046		27.9046	

[a/] The absolute values of "t" are shown in parentheses. These are not exact t-tests, they are asymptotically normal variables. The reference to "t-tests" is to provide an analog to ordinary least squares regression. * = significant at 0.10 level; ** = significant at 0.05 level; *** = significant at 0.01 level.

[b/] Is the log of the likelihood ratio. For large n, -2λ is distributed chi-square with k degrees of freedom, where k is the number of explanatory variables in the regression other than the constant. This is analogous to an F-test on a vector of coefficients in standard OLS regressions.

[c/] The expected mean of T_{MH} is calculated at the mean of all explanatory variables.

when on-farm labor activities are sex specific. The coefficient for the wife's market wage, W_{MW}, was also found not to differ significantly from zero.

The nonearned income variable, V, was also insignificant. While the coefficient had the expected negative coefficient in the first model, it was positive when environmental variables were included. This result may indicate an interaction between nonearned income and the environmental variable.

The coefficient for farm size had the expected negative sign and was significant at the .05 level. This implies that a decrease in average farm size would increase off-farm labor supply. The partial elasticity was close to -1.0. This implies that as farm size decreases 10 percent to 2.2 hectares, the husband's off-farm supply of labor will increase by about 10 percent to 30 days per year, ceteris paribus.

Household composition was also shown to influence the off-farm labor supply of husbands. The number of children in all age categories was found to exert the theoretically predicted positive effect. While the number of children between the ages of seven and fifteen was not statistically significant, the numbers of children under seven and those over fifteen were found to be significant at the .10 and .01 levels, respectively. Thus the husband appears to work more off the farm when young children are present, perhaps to compensate for the loss of income when the wife reduces her out-of-home work effort. Older children, on the other hand, may substitute for the husband's farm labor input, thereby releasing some of his time for off-farm activities.

The coefficients for the variables of machine stock and size of home dwelling had the expected signs, though neither was found to be statistically significant from zero.

To summarize, it was shown that of the income and wage variables, only the husband's off-farm wage is a significant determinant of husbands' off-farm labor supply. Several interesting and significant results emerged when the environmental variables were included. In particular it was found that farm size and household composition were also important factors in determining off-farm labor supply.

Regression Results for Farm Wives

The results for equation 19 for farm wives are found in Table 6. The test of model significance, -2λ , indicates that the hypothesis that all coefficients equal zero cannot be rejected for either regression. When the predicted probablity of off-farm work and expected number of days worked off the farm are compared with the data, it was found again that the basic wage and income model yields the best fit.

The wage rate results were contrary to expectations. Table 6 indicates that the wife's time allocation decisions are more influenced by the husband's parameters than her own. The negative, though insignificant, coefficient for the husband's on-farm wage suggests that the wife's farm labor input may be a complement to the husband's farm time. Similarly, the positive coefficients attached to the husband's off-farm wage and the household's nonearned income variables imply that there may well be a difference in the taste for off-farm work across households. A further conclusion is that at the margin, the wife's time in home pro-

Table 6: Regressions Coefficients and Related Statistics for Models of Farm Wives Using Tobit Procedures[a/]

Independent Variables	Regression (1)	Partial Elasticities	Regression (2)	Partial Elastiticities
Intercept	-730.4935** (2.36)		-690.4507** (2.21)	
W_{FH}	-0.4176 (0.28)	-0.047	-0.5041 (0.35)	-0.059
W_{MH}	19.6911 (1.39)	2.825	23.2092 (1.60)	3.406
W_{FW}	2.0703* (1.70)	0.201	1.9072 (1.52)	0.189
W_{MW}	-2.5000 (0.08)	0.100	-7.8052 (0.24)	-0.319
V	0.0038 (0.16)	0.018	0.0280 (1.06)	0.134
F			-43.6804* (1.51)	-0.800
M			-0.0126 (0.76)	-0.143
C_{06}			-32.2645 (0.71)	-0.147
C_{715}			7.9547 (0.34)	0.121
O			-0.9522 (0.09)	-0.017
S			0.2198 (0.66)	0.167
-2 [b/]	5.285		9.415	
Predicted Probability of Off-Farm Work	0.113		0.102	
Observed Frequency of Off-Farm Work	0.122		0.122	
Expectd Mean of T_{MW}[c/]	15.3918		13.5388	
Observed Mean of T_{MW}	16.7687		15.7687	

[a/] The absolute values of "t" are shown in parentheses. These are not exact t-tests, they are asymptotically normal variables. The reference "t-tests" is to provide an analog to ordinary least squares regression. * = significant at the 0.10 level; ** = significant at the 0.05 level; *** = significant at the 0.01 level.

[b/] λ is the log of the likelihood ratio. For large n, -2λ is distributed chi-square with k degrees of freedom, where k is the number of explanatory variables in the regression other than the constant. This is analogous to an f-test on a vector of coefficients in standard OLS regression.

[c/] The expected mean of T_{MW} is calculated at the mean of all explanatory variables.

duction may be of limited value and could better be allocated to off-farm activities if more were available.

The coefficients for the wife's own wage rates are more difficult to explain. The results indicate that an increase in the wife's own farm wage may lead to an increase in her off-farm labor supply, while an increase in the off-farm wage may reduce the off-farm supply. These results are contrary to the theory of time allocation and suggest that the wife and hence the household is unable to maximize the utility function. There are several possible explanations. First, since the dependent variable is days, including part-days worked off the farm rather than man-days, it is conceivable that the wife works only a few hours per day off the farm. A second explanation lies in the construction of the variables and the manner in which they were recorded. The subjective nature of the replacement cost concept may be a source of bias due to response error. That is, those wives who are employed in off-farm activities may perceive their off-farm wage as the value of their farm time. Thus the coefficient of the wife's on-farm wage rate may reflect a change in the wife's actual off-farm wage rate. A final explanation may be related to the finding that the primary on-farm labor activity of women who worked off the farm was livestock care, which was found to have the highest replacement cost. Therefore the positive coefficient associated with the wife's on-farm replacement cost may indicate a positive relationship between this on-farm activity, rather than farm productivity generally, and time worked off the farm.

Turning to the environmental variables, it was found that farm size had the expected coefficient and was significant at the 10 percent

level. The partial elasticity of -.80 was slightly lower than the corresponding elasticity for husbands. This may indicate that farm husbands are more responsive to a change in farm size than are farm wives.

The houshold composition variables revealed the expected effects of children and other household members upon the off-farm labor supply of wives. Theoretically, younger children are considered to be time-intensive goods that later become more goods-intensive before entering into time allocation decisions. Although not statistically significant, the negative coefficients associated with C_{06} and 0, and the positive coefficient associated with C_{715} indicate that the hypothesized effects of children appear to hold for wives. The variables for machine stock and house size had signs opposite those predicted by theory but the coefficients were not significantly different from zero.

The theoretical predictions suggested that the off-farm labor response of the wife would be more sensitive to a given change in off-farm wage rates than is the case with husbands, ceteris paribus. The empirical results found by comparing the uncompensated elasticities of the off-farm wage variables in Tables 5 and 6 reveal that the cross elasticity of off-farm labor response is in fact greater for farm wives than for farm husbands. The prediction regarding own wage elasticity was not supported by the data, however, which indicates that the husband's own wage elasticity is considerably greater than that of the wife.

The model for farm wives predicted reasonably well the probability of working off the farm. Yet the contribution of individual variables was found to be generally insignificant, and often the coefficient

possessed a sign contrary to theoretical predicitons. This suggests that the off-farm labor supply of farm wives may be determined to a greater degree by factors related to the taste for off-farm employment and the opportunity for off-farm employment than is the case for husbands.

CONCLUSIONS

Off-farm income is important for small rice growing households in Laguna in the Philippines. It was found that in one-third of the households, one or both spouses worked off the farm. Children were found to earn a surprisingly large amount of off-farm income and their behavior should be incorporated into future studies of household time allocation. The elasticity of off-farm labor supply for husbands with respect to off-farm wage rate exceeded 3, a level much higher than for a sample of U.S. farmers. This suggests a highly elastic reponse to off-farm work. On the other hand, the husband's on-farm wages and the wife's farm and off-farm wages all had insignificant effects on husband's off-farm time allocation. Farm size, however, had the expected negative sign. Furthermore, the number of young and older children had the expected positive effect.

The model tested to explain time allocation of wives did not produce as good results. The coefficients were frequently insignificant and had signs contrary to theory. A number of problems were identified that may explain this result.

The findings, in general, encourage the utilization of the household economics approach in the study of time allocation in low income economies. The results indicate that the assumptions of the model, in particular the assumption that the individual may allocate his time without encountering institutional barriers, may be more relevant to husbands than wives. Wage and income variables, however, appear to be incomplete determinants of household behavior. The environmental

characteristics, particularly farm size and household composition, contributed substantially to the results. On the one hand, these results suggest that such characteristics are exogenous to time allocation decisions in a single time period. Yet, farm size as it affects income earning potential, and household composition as it affects the need for income may influence the effort a household will devote to locating suitable off-farm work. Future studies should also analyze both the taste for work and the prospects for success in the job search. While these parameters were excluded from the current data base, it is believed that they would contribute much to the understanding of household time allocation.

Philippine farm households appear to respond to the "pull" factor of increased off-farm wage rates. Decisions by husbands to work off the farm and the amount of time to supply to off-farm wage rate. It also appears that farm size and household composition are important "push" factors that encourage farm household members to allocate their time to off-farm activities.

Recommended government policies are unclear. Increased wages and rural job opportunities would appear to illicit a strong labor supply response resulting in increased employment and income of rural families. Since households with smaller farms, lower incomes, and larger families would be expected to be most responsive, rural income distribution would be improved. On the other hand, the possible impact on farm production needs to be recognized. Substantial amounts of off-farm work could result in a decline in production, thereby putting more pressure on consumer prices. Japan and Taiwan effectively combine farm and non-farm

employment, but these countries have agricultural sectors which have experienced a long record of technological change and adaption. While the Philippines has made progress, particularly in the areas of rice cultivation and research, there is a lag in both agricultural technology and in rural nonagricultural industries. A future agricultural development strategy emphasizing off-farm employment must simultaneously improve agricultural technology and efficiency so that a reallocation of more time by farm household members to off-farm work is accompanied by appropriate productivity changes and reorganization of work on farms.

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